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POPULATION DYNAMICS OF PROTELEAN PARASITES (HYMENOPTERA: APHELINIDAE) ATTACKING A NATURAL POPULATION OF *TRIALEURODES PACKARDI* (HOMOPTERA: ALEYRODIDAE) AND NEW HOST RECORDS FOR TWO SPECIES[1]

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Abstract.—The natural population interactions of a complex of aphelinid parasites with the host *Trialeurodes packardi* (Morrill) were studied for two growing seasons. New host records were established for *Encarsia pergandiella* Howard and *E. quaintancei* Howard. Parasites were a significant mortality factor for the whitefly population, and *Encarsia pergandiella* dominated the parasite complex numerically. Male *E. pergandiella*, hyperparasites of female *Encarsia*, increased dramatically in numbers at the end of the growing season.

The population biology and dynamics of some parasitic Hymenoptera attacking aleyrodids have been studied under controlled conditions (Burnett, 1949, 1958, 1960, 1962; Gerling, 1966a, 1966b; Helgesen and Tauber, 1974), and the composition of a species complex parasitizing one naturally-occurring aleyrodid population has been reported (Dysart, 1966). However, no information is available concerning the population dynamics of an intact parasite complex supported by a natural aleyrodid population. This communication describes the population dynamics of the constituents of a chalcidoid complex parasitizing a naturally-occurring population of the strawberry whitefly, *Trialeurodes packardi* (Morrill), on a preferred host plant, jewelweed, *Impatiens pallida* Nuttall (Kuenzel, 1975) and reports new host records for two parasite species.

Methods

The study area was located on the north bank of Beebe Lake, Ithaca, New York. The population of the host, *Trialeurodes packardi*, and surface area of *Impatiens* leaves available to whiteflies were sampled at weekly intervals of the growing season in 1972 and 1973 until demise of the plants in the fall. The leaf was employed as the sampling unit. Leaves were collected by the regime described by Kuenzel (1975) and were refrigerated at 2°C until insects could be counted. A stereomicroscope was employed in enumeration, and numbers per leaf of each immature whitefly stadium and parasitized larva were noted. Parasitism was first apparent in fourth-instar whiteflies using this technique. Numbers per leaf were divided by leaf surface area, and a mean density of unparasitized and parasitized white-

fly larvae was computed for each weekly sample. These means were multiplied by the mean surface area of *Impatiens* plants for that week to give an estimate of mean number of insects per mean plant in each collection. In 1973, each parasitized whitefly and a small section of the leaf were cut from the rest of the leaf with a cork borer. Each parasitized larva was incubated individually in a gelatin capsule at 25°C, and the emergent parasite was preserved in 75% ethanol for identification. After obviously parasitized larvae were removed from the leaf, the remainder of the leaf was incubated at 25°C on moistened filter paper in a covered petri dish to determine if any whiteflies were parasitized that had not appeared so at time of counting. Counts of fourth-instar whiteflies were corrected for any parasitism appearing after incubation.

To estimate the absolute numbers per plant of each species and sex of parasite larva in 1973, proportions of each sex and species emerging from the gelatin capsules for each weekly collection were multiplied by the mean number of parasitized whiteflies per plant for that collection. Although a quantitative sample of parasite species was taken only in 1973, some parasite larvae collected in 1971 and 1972 were also reared and preserved for identification.

The estimate of parasitism is conservative because during incubation leaves often began to mold within a few days and thus prohibited development of the whiteflies and their parasites. Even on healthy leaves, it seems likely that experimental conditions and initial cold storage would decrease the number of parasites developing relative to the number successfully maturing in the field. Additionally I assumed that all sexes and species of parasite responded similarly to conditions of incubation in the gelatin capsules.

Results and Discussion

All parasites were aphelinids. In 1971 the following species and sexes were collected: *Encarsia pergandiella* Howard, females; *Encarsia quaintancei* Howard, females; *Encarsia* spp. males; and *Eretmocerus corni* Haldeman, one male and one female. In 1972 and 1973 both sexes of *Encarsia pergandiella* and *E. corni* were collected, but *E. quaintancei* was absent. The males classified as *E. pergandiella* in 1973 could not be definitely confirmed as that species because they appeared quite similar to *E. quaintancei*. It is likely that they were *E. pergandiella*, however, since no female *E. quaintancei* were collected in 1973. Furthermore, males of *E. pergandiella* are hyperparasitic upon *Encarsia* females (Gerling, 1966a), and a hyperparasitized larva can be detected because the remains of the primary parasite are visible as a dark spot through the whitefly pupal case when the hyperparasite reaches the prepupal stage. Half of the

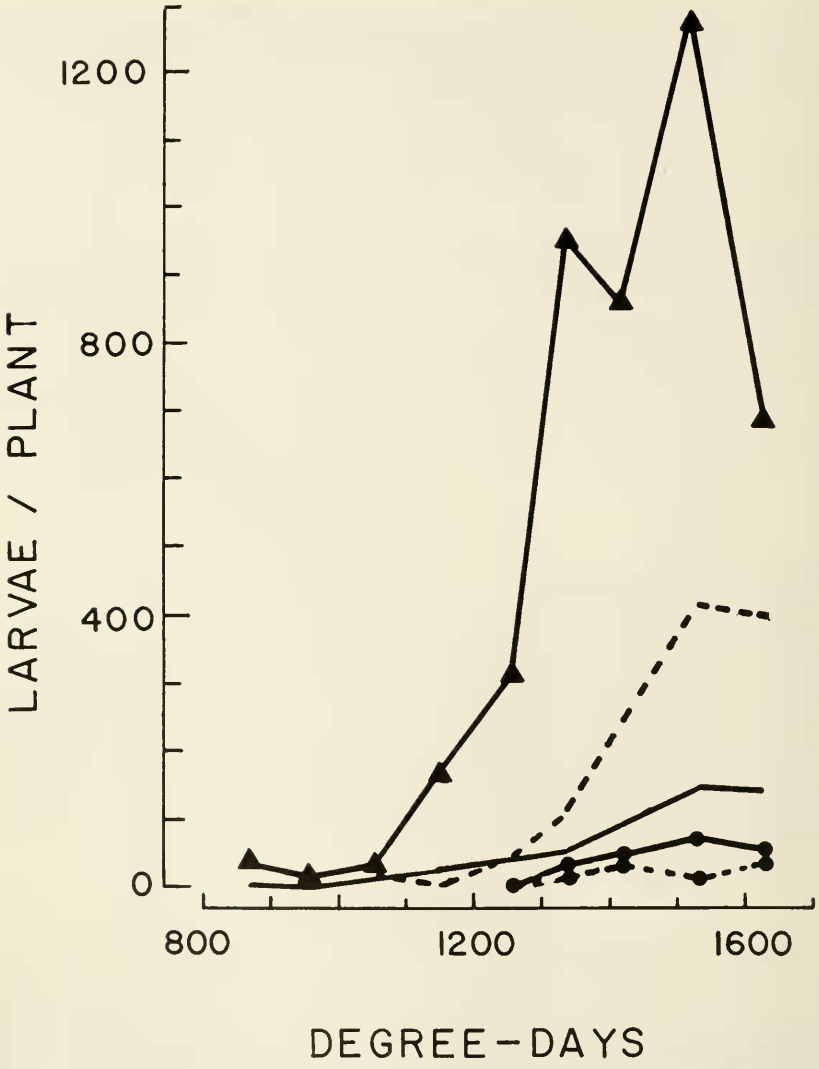

Fig. 1. Number of *Trialeurodes packardi* fourth-instar larvae per *Impatiens* plant parasitized by *Encarsia pergandiella* males (– – –), *E. pergandiella* females (——), *Eretmocerus corni* males (– ● –) and *E. corni* females (–●–) compared to the number per plant of unparasitized *Trialeurodes packardi* fourth instars (–▲–). The chronological scale is in accumulated degree-days (°C above 8°).

whitefly pupal cases producing male *Encarsia* specimens sent for determination distinctly exhibited this characteristic.

Trialeurodes packardi has not previously been reported as a host for *Encarsia pergandiella.* Other known hosts are the aleyrodids *Pealius azaleae* (Baker and Moles), *Aleyrodes spiraeoides* Quaintance, *Trialeurodes vaporariorum* (Westwood), *Aleyrodes* spp. (Gerling, 1966a) and *Trialeurodes abutilonea* (Haldeman) (Dysart, 1966). *Trialeurodes packardi* is also a new host record for *Encarsia quaintancei.* Previously reported hosts for this parasite are *Aleyrodes* spp. on *Polygonum* (Peck, 1963) and *Trialeurodes abutilonea* (Dysart, 1966).

Analysis of the quantitative sample of the parasite complex in 1973 is illustrated in Fig. 1 and compared to the number of unparasitized fourth-instar whiteflies. Numbers of insects per plant are considered relative to accumulated degree-days above 8°C, the theoretical developmental zero for *T. packardi* (Kuenzel, 1975). Initial appearances of both *Encarsia pergandiella* and *Eretmocerus corni* were on the same date, 869 degree-days (July 17). However *Encarsia pergandiella* increased in numbers while *Eretmocerus corni* declined, disappeared and was not collected again until 1,336 degree-days (August 21). The total number of *E. corni* per plant never exceeded 100 individuals, and females were more abundant than males. Populations of both sexes of *Encarsia pergandiella* increased exponentially from the time of first appearance to 1,528 degree-days (September 9) when a plateau was reached. This cessation of growth in parasite numbers is probably related to the decline in numbers of available hosts. The sex ratio of *E. pergandiella* oscillated around 50% until 1,416 degree-days (August 28) when a dramatic increase in number of males was observed. The maximum numbers per plant of primary parasites and hyperparasites were 139 and 417, respectively, occurring at 1,528 degree-days.

One objective of this study was to provide data on abundance of parasite species attacking a naturally-occurring whitefly population throughout the growing season in order to complement existing studies of whiteflies and their parasites in controlled situations. This investigation indicates that one species may dominate, throughout the summer, a complex of parasites attacking a natural whitefly population. Similarly, Dysart (1966) found that two species accounted for 86% of all parasites attacking a natural population of *Trialeurodes abutilonea* in one summer and that *Encarsia quaintancei* dominated the complex constituting 63% of the specimens. Therefore it appears that the artificial whitefly communities consisting of single whitefly and parasite populations studied by Burnett (1949, 1958, 1960, 1962) and Helgesen and Tauber (1974) are similar in composition to at least some natural communities.

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Footnote

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